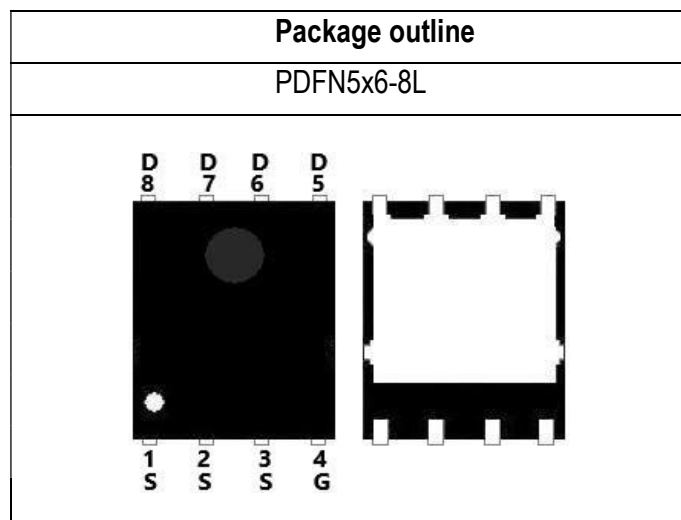


| Key parameter                         | Value | Unit |
|---------------------------------------|-------|------|
| $V_{(BR)DSS \text{ min.}}$            | 150   | V    |
| $R_{DS(ON) \text{ max. } V_{GS}=10V}$ | 11.4  | mΩ   |
| $I_D$                                 | 45.0  | A    |
| $V_{GS(TH) \text{ Typ.}}$             | 3.1   | V    |
| $C_{iss \text{ Typ.}}$                | 3659  | pF   |
| $Q_g \text{ 10V Typ.}$                | 46.2  | nC   |
| $E_{AS}$                              | 33.8  | mJ   |



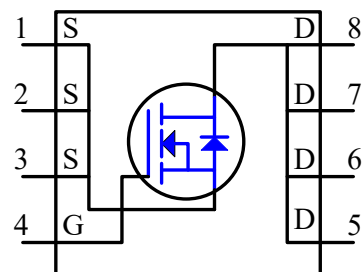
## Description

These devices used double-gate structure of MOSFET to provide excellent electrical parameter. There is high-speed switching capacity, low  $R_{DS(ON)}$  resistance, low gate charge and stable characteristics for these devices. Moreover, it is a helpful choose for raise efficiency or reduce consumption in circuit. These features combine to be an advantage design for use in wide variety of application including converter and inverter design.

## Features

- ◇ Fast switch capacity
- ◇ Low  $R_{DS(ON)}$  resistance
- ◇ Low input capacitance
- ◇ With voltage logic level driving characteristics
- ◇ Pb-free lead plating; RoHS compliant

## Symbol and Pin assignment



## Potential application

- AC to DC adaptor
- DC to DC Converter
- Power Switch Mode Supply
- Synchronous Rectifier for Power Delivery
- Network equipment and display power supply unit

## Order Information

| Item                | Description  |
|---------------------|--------------|
| 1. Order Code       | DG150N03Q    |
| 2. Part Number      | DG150N03Q    |
| 3. Package Type     | PDFN5x6-8L   |
| 4. Package Code     | Q            |
| 5. Packing Type     | Tape & Reel  |
| 6. Quantity in Pack | 2,500        |
| 7. RoHS Status      | Halogen-Free |

## Content

| Section | Subject                                         | Page |
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| 1.      | Absolute Maximum Ratings -----                  | 3    |
| 2.      | Thermal Resistance Ratings -----                | 3    |
| 3.      | Electrical Characteristics -----                | 4    |
| 4.      | Typical Operating Characteristics Diagram ----- | 5-7  |
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## 1. Absolute Maximum Ratings ( $T_J=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter                                           |                                              | Symbol         | Value      | Unit                  |
|-----------------------------------------------------|----------------------------------------------|----------------|------------|-----------------------|
| Drain-Source Voltage                                |                                              | $V_{DS}$       | 150        | V                     |
| Gate-Source Voltage                                 |                                              | $V_{GS}$       | $\pm 20$   | V                     |
| Drain Current-Continuous <small>Note 1</small>      | $T_C=25^{\circ}\text{C}$                     | $I_D$          | 45.0       | A                     |
|                                                     | $T_C=100^{\circ}\text{C}$                    |                | 28.4       | A                     |
| Drain Current-Continuous <small>Note 2</small>      | $T_A=25^{\circ}\text{C}$                     | $I_D$          | 9.50       | A                     |
|                                                     | $T_A=70^{\circ}\text{C}$                     |                | 7.60       | A                     |
| Drain Current-Pulsed <small>Note 3</small>          | $T_A=25^{\circ}\text{C}$                     | $I_{DM}$       | 150        | A                     |
| Avalanche Current                                   |                                              | $I_{AR}$       | 26.0       | A                     |
| Single Pulse Avalanche Energy <small>Note 4</small> |                                              | $E_{AS}$       | 33.8       | mJ                    |
| Maximum Power Dissipation                           | $T_C=25^{\circ}\text{C}$                     | $P_D$          | 47.8       | W                     |
|                                                     | $T_C=100^{\circ}\text{C}$                    |                | 19.1       | W                     |
|                                                     | $T_A=25^{\circ}\text{C}$                     |                | 2.13       | W                     |
|                                                     | $T_A=70^{\circ}\text{C}$                     |                | 1.36       | W                     |
|                                                     | Derate Factor Above $T_C=25^{\circ}\text{C}$ |                | 0.38       | W/ $^{\circ}\text{C}$ |
| Max. Operating Junction Temperature                 |                                              | $T_J$          | 150        | $^{\circ}\text{C}$    |
| Operating and Storage Temperature Range             |                                              | $T_J, T_{STG}$ | -55 to 150 | $^{\circ}\text{C}$    |

## 2. Thermal Resistance Ratings

| Parameter                            | Symbol            | Conditions             | Min. | Typ. | Max.  | Unit                        |
|--------------------------------------|-------------------|------------------------|------|------|-------|-----------------------------|
| Thermal resistance, Junction-Case    | $R_{\theta JC-N}$ | Please refer to Note 5 | -    | -    | 2.61  | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance, Junction-Ambient | $R_{\theta JA-N}$ | Please refer to Note 5 | -    | -    | 58.65 | $^{\circ}\text{C}/\text{W}$ |

### Notes:

- Limited by silicon chip capability and  $R_{\theta JC-N}$  junction-to-case thermal resistance.
- The maximum current rating is limited by package and  $R_{\theta JA-N}$  junction-to-ambient thermal resistance.
- Must be ensure junction temperature does not exceed 150-degree C. (Pulse Width  $\leq 380\mu\text{s}$ , Duty  $\leq 2\%$ )
- Limited by  $T_{Jmax}$ , starting  $T_J=25^{\circ}\text{C}$ ,  $L=0.1\text{mH}$ ,  $R_g=25\Omega$ ,  $I_D=26.0\text{A}$ ,  $V_{GS}=10\text{V}$ .
- The value of thermal resistance is measured with the single device mounted on 1 inch<sup>2</sup> FR-4 PCB with 2 oz. copper under a still air environment temperature is  $25^{\circ}\text{C}$  based on JEDEC standard JESD51-14 and JESD51-2a. Thermal resistance obtained depends on the user's specific board design and given application.

### 3. Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

| STATIC CHARACTERISTICS          |                      |                                                                   |      |      |      |      |
|---------------------------------|----------------------|-------------------------------------------------------------------|------|------|------|------|
| Parameter                       | Symbol               | Conditions                                                        | Min. | Typ. | Max. | Unit |
| Drain-Source Breakdown Voltage  | V <sub>(BR)DSS</sub> | V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA                       | 150  | -    | -    | V    |
| Zero Gate Voltage Drain Current | I <sub>DSS</sub>     | V <sub>DS</sub> =150V, V <sub>GS</sub> =0V                        | -    | -    | 1    | μA   |
|                                 |                      | V <sub>DS</sub> =150V, V <sub>GS</sub> =0V, T <sub>J</sub> =125°C | -    | -    | 10   | μA   |
| Gate-Body Leakage               | I <sub>GSS</sub>     | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                        | -    | -    | ±100 | nA   |

| STATIC CHARACTERISTICS           |                     |                                                           |      |      |      |      |
|----------------------------------|---------------------|-----------------------------------------------------------|------|------|------|------|
| Parameter                        | Symbol              | Conditions                                                | Min. | Typ. | Max. | Unit |
| Gate Threshold Voltage           | V <sub>GS(TH)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA | 2.0  | 3.1  | 4.0  | V    |
| Drain-Source On-State Resistance | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>DS</sub> =20A                | -    | 10.2 | 11.4 | mΩ   |
| Gate Resistance                  | R <sub>g</sub>      | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz          | -    | 2.3  | -    | Ω    |
| Forward Transconductance         | g <sub>fs</sub>     | V <sub>DS</sub> =5V, I <sub>DS</sub> =20A                 | -    | 29.0 | -    | S    |

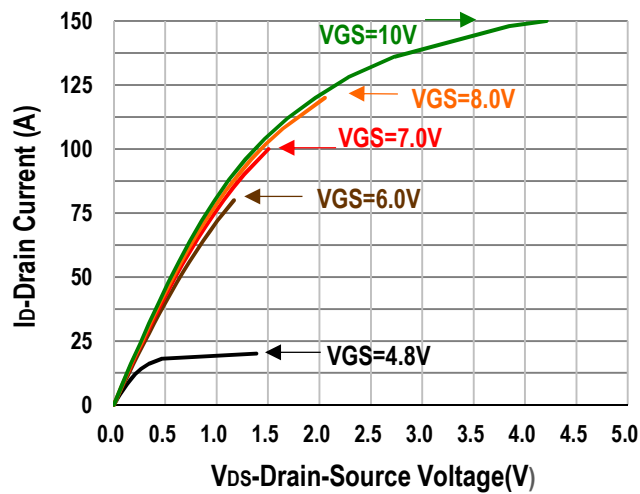
| DYNAMIC CHARACTERISTICS      |                     |                                                                                          |      |      |      |      |
|------------------------------|---------------------|------------------------------------------------------------------------------------------|------|------|------|------|
| Parameter                    | Symbol              | Conditions                                                                               | Min. | Typ. | Max. | Unit |
| Input Capacitance            | C <sub>iss</sub>    | V <sub>DD</sub> =150V, V <sub>DS</sub> =80V, V <sub>GS</sub> =0V, F=1MHz                 | -    | 3659 | -    | pF   |
| Output Capacitance           | C <sub>oss</sub>    | V <sub>DD</sub> =150V, V <sub>DS</sub> =80V, V <sub>GS</sub> =0V, F=1MHz                 | -    | 240  | -    | pF   |
| Reverse Transfer Capacitance | C <sub>rss</sub>    | V <sub>DD</sub> =150V, V <sub>DS</sub> =80V, V <sub>GS</sub> =0V, F=1MHz                 | -    | 6.6  | -    | pF   |
| Turn-On Delay Time           | T <sub>d(on)</sub>  | V <sub>DS</sub> =75V, V <sub>GS</sub> =10V, I <sub>DS</sub> =20A, R <sub>GEN</sub> =3.0Ω | -    | 14.0 | -    | nS   |
| Rise Time                    | T <sub>r</sub>      | V <sub>DS</sub> =75V, V <sub>GS</sub> =10V, I <sub>DS</sub> =20A, R <sub>GEN</sub> =3.0Ω | -    | 24.3 | -    | nS   |
| Turn-Off Delay Time          | T <sub>d(off)</sub> | V <sub>DS</sub> =75V, V <sub>GS</sub> =10V, I <sub>DS</sub> =20A, R <sub>GEN</sub> =3.0Ω | -    | 33.7 | -    | nS   |
| Fall Time                    | T <sub>f</sub>      | V <sub>DS</sub> =75V, V <sub>GS</sub> =10V, I <sub>DS</sub> =20A, R <sub>GEN</sub> =3.0Ω | -    | 20.3 | -    | nS   |

| GATE CHARGE CHARACTERISTICS                                      |                      |                                                                      |      |      |      |      |
|------------------------------------------------------------------|----------------------|----------------------------------------------------------------------|------|------|------|------|
| Parameter                                                        | Symbol               | Conditions                                                           | Min. | Typ. | Max. | Unit |
| Gate to Source Gate Charge                                       | Q <sub>gs</sub>      | V <sub>DD</sub> =50V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V | -    | 19.5 | -    | nC   |
| Gate charge at threshold                                         | Q <sub>g(th)</sub>   | V <sub>DD</sub> =50V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V | -    | 11.4 | -    | nC   |
| Gate to Drain Charge                                             | Q <sub>gd</sub>      | V <sub>DD</sub> =50V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V | -    | 3.6  | -    | nC   |
| Switching charge                                                 | Q <sub>SW</sub>      | V <sub>DD</sub> =50V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V | -    | 11.7 | -    | nC   |
| Gate charge total                                                | Q <sub>g 10V</sub>   | V <sub>DD</sub> =50V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V | -    | 46.2 | -    | nC   |
| Gate plateau voltage                                             | V <sub>plateau</sub> | V <sub>DD</sub> =50V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V | -    | 5.0  | -    | V    |
| Gate charge total, sync. FET (Q <sub>g</sub> - Q <sub>gd</sub> ) | Q <sub>g(sync)</sub> | V <sub>DS</sub> =0.1V, V <sub>GS</sub> =0 to 10V                     | -    | 42.6 | -    | nC   |

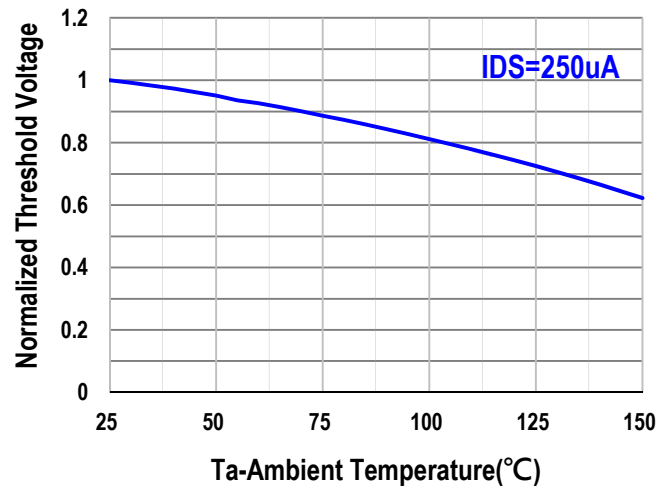
| DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS |                 |                                                          |      |      |      |      |
|--------------------------------------------------------|-----------------|----------------------------------------------------------|------|------|------|------|
| Parameter                                              | Symbol          | Conditions                                               | Min. | Typ. | Max. | Unit |
| Body Diode continuous forward current                  | I <sub>S</sub>  | T <sub>C</sub> =25°C                                     | -    | -    | 45   | A    |
| Body Diode pulse current                               | I <sub>SM</sub> | T <sub>C</sub> =25°C                                     | -    | -    | 150  | A    |
| Body Diode Forward Voltage                             | V <sub>SD</sub> | V <sub>GS</sub> =0V, I <sub>S</sub> =20A                 | -    | 0.83 | 1.0  | V    |
| Body Diode Reverse Recovery Time                       | t <sub>rr</sub> | V <sub>DD</sub> =75V, I <sub>F</sub> =20A, di/dt=100A/μs | -    | 73.7 | -    | nS   |
| Body Diode Reverse Recovery Charge                     | Q <sub>rr</sub> | V <sub>DD</sub> =75V, I <sub>F</sub> =20A, di/dt=100A/μs | -    | 169  | -    | nC   |
| Body Diode Reverse Recovery Current                    | I <sub>rm</sub> | V <sub>DD</sub> =75V, I <sub>F</sub> =20A, di/dt=100A/μs | -    | 3.93 | -    | A    |

## 4. Typical Operating Characteristics Diagram

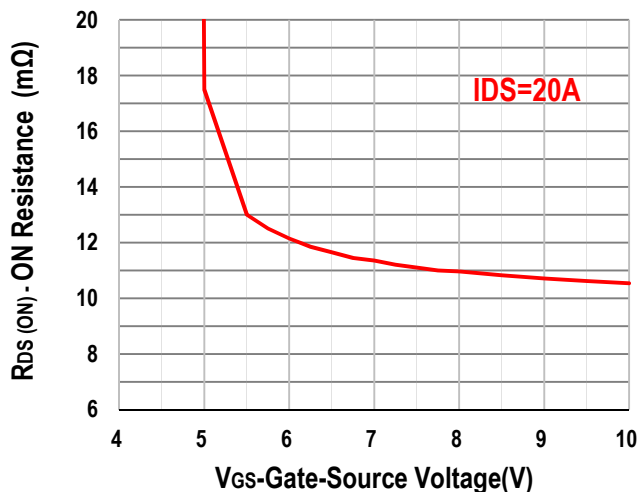
**Fig. 1: Output Characteristics**



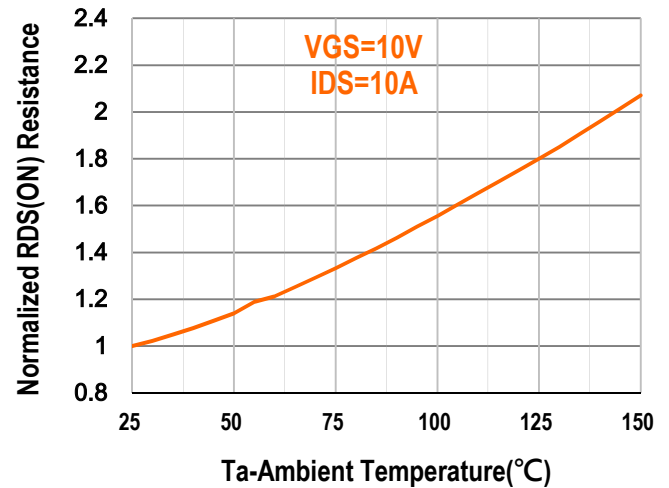
**Fig. 2: Normalized  $V_{(TH)GS}$  Voltage Vs.  $T_A$**



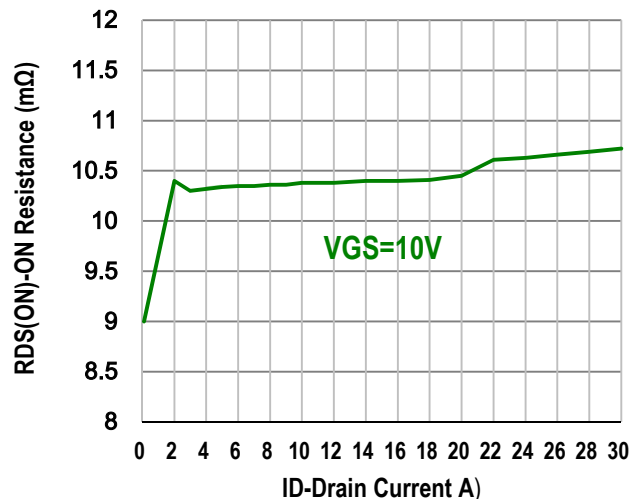
**Fig. 3: Drain-Source On Resistance Vs  $V_{GS}$**



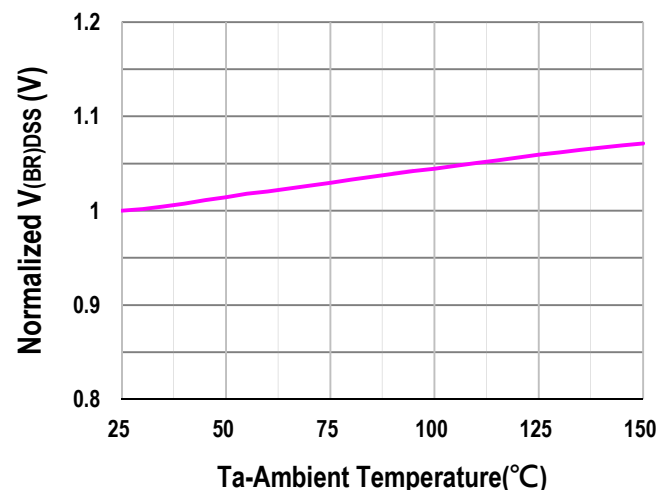
**Fig. 4: Normalized  $R_{DS(ON)}$  Resistance Vs.  $T_A$**



**Fig. 5: Drain-Source On Resistance Vs  $I_D$**

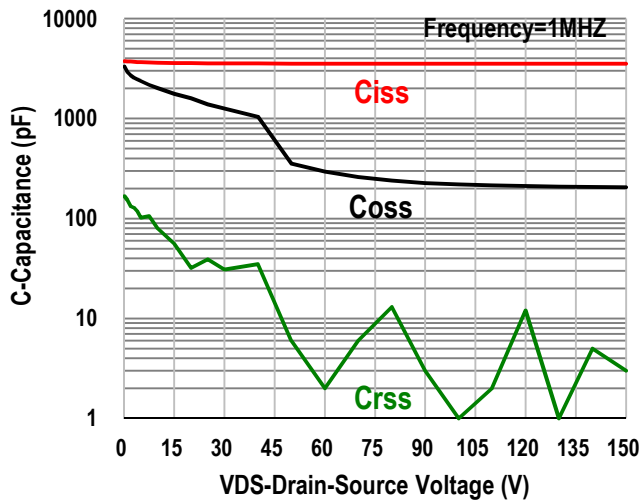


**Fig. 6: Normalized  $B_{VDSS}$  Voltage Vs  $T_A$**

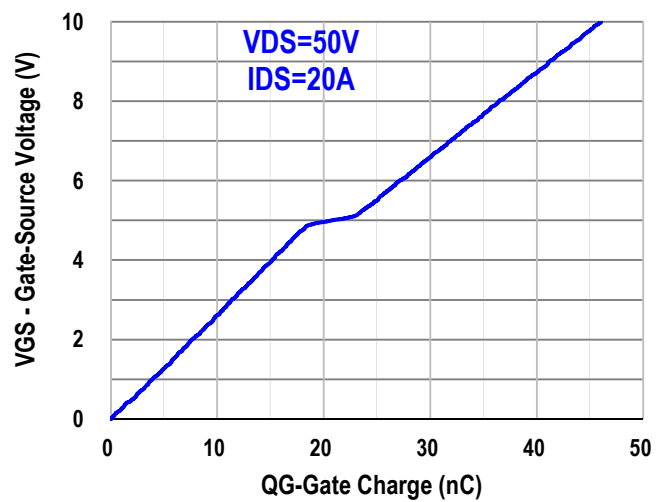


#### 4. Typical Operating Characteristics Diagram

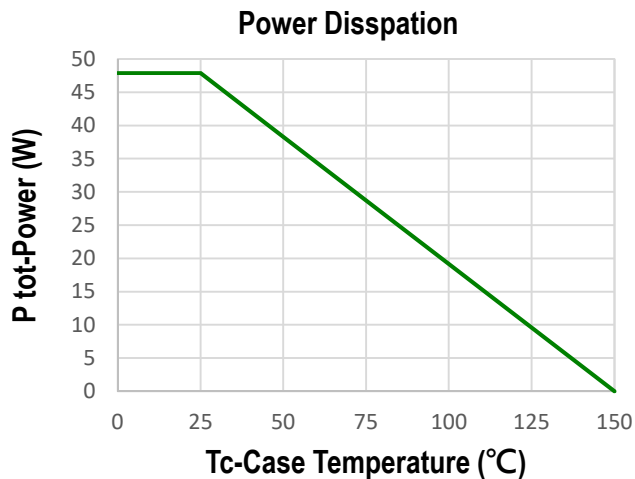
**Fig. 7: Typical Capacitance Variation Vs  $V_{DS}$**



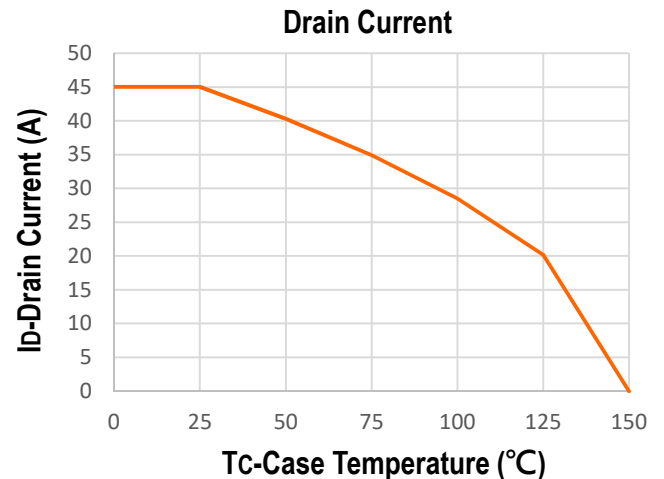
**Fig. 8: Gate Charge Vs  $V_{GS}$**



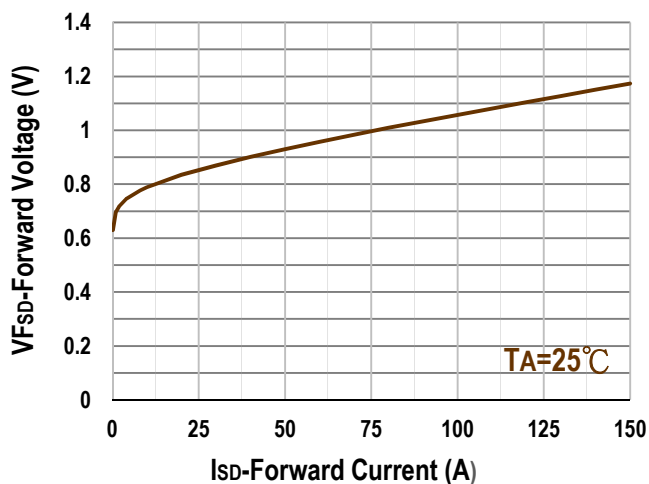
**Fig. 9: Power Dissipation Vs.  $T_C$**



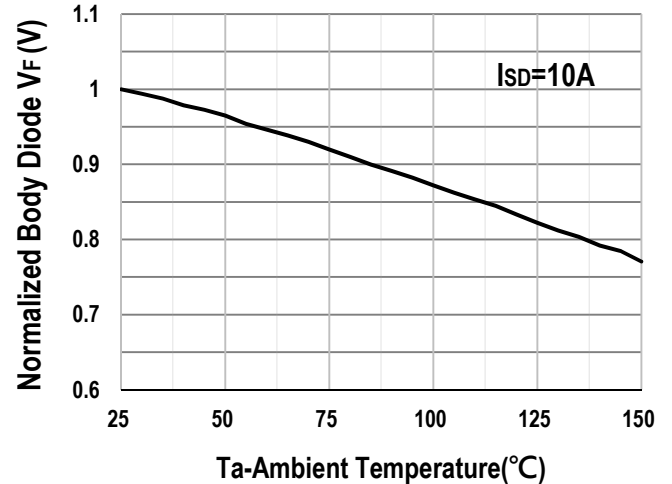
**Fig. 10: Drain Current Vs.  $T_C$**



**Fig. 11: Body Diode Forward Voltage Vs.  $I_S$**

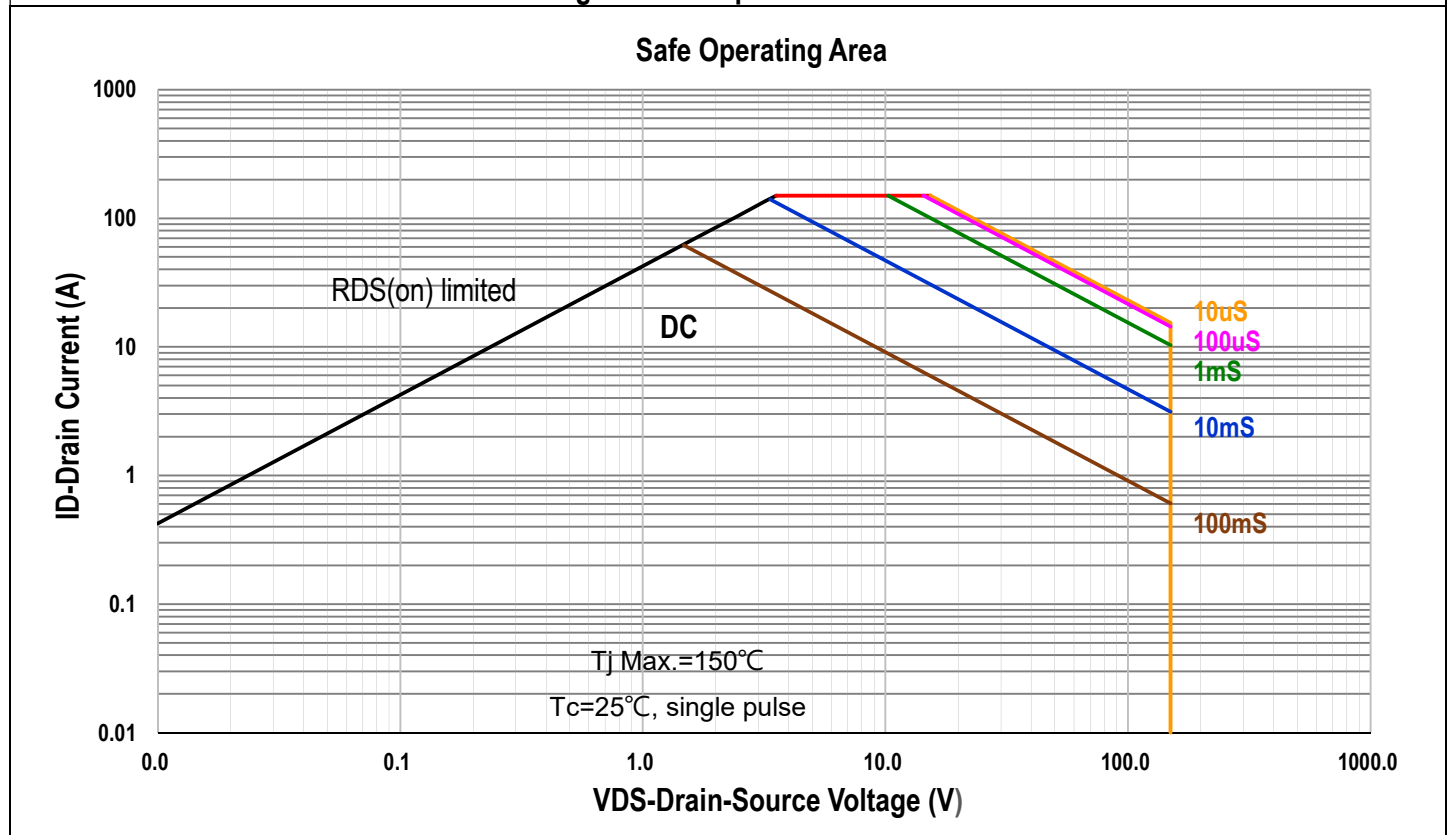


**Fig. 12: Normalized Body Diode Forward Voltage Vs.  $T_A$**

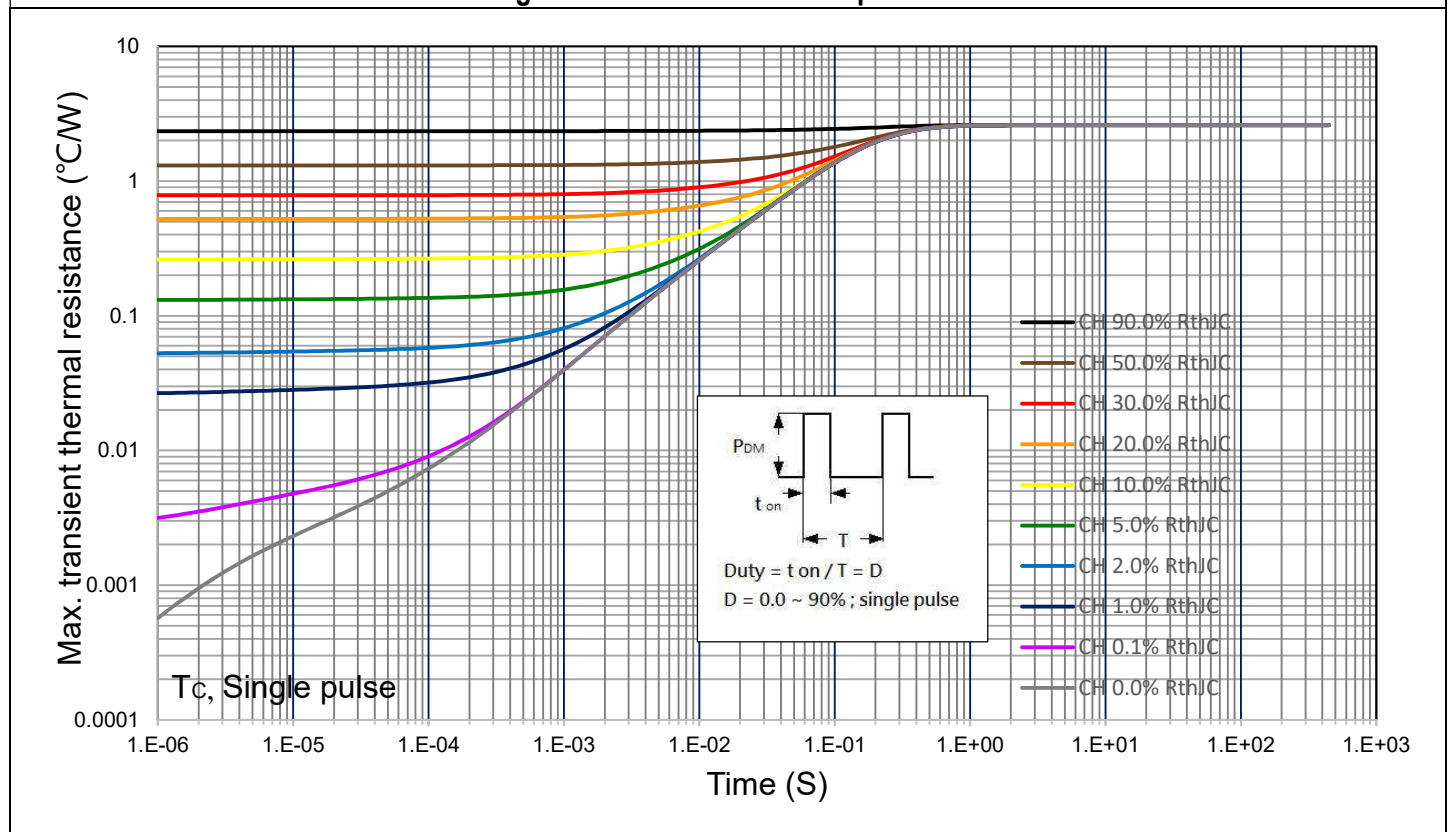


#### 4. Typical Operating Characteristics Diagram

**Fig. 13: Safe Operation Area**

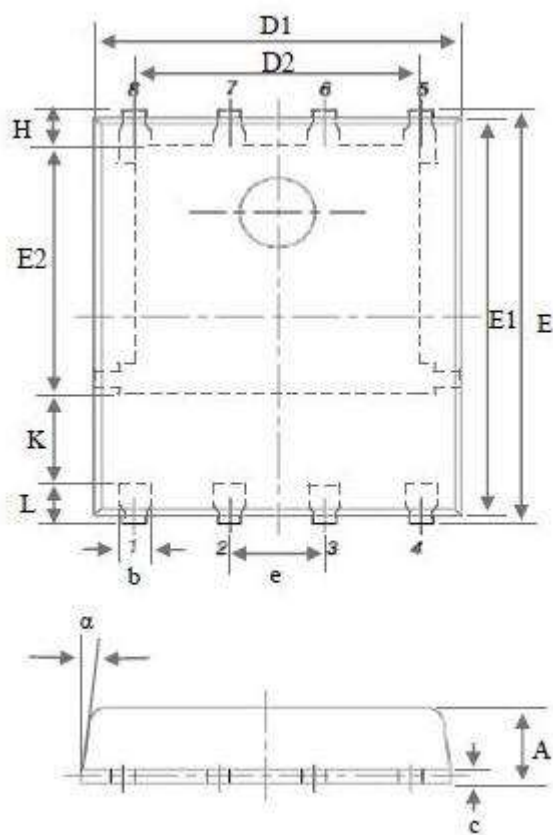


**Fig. 14: Transient Thermal Impedance**



## 5. Package of Dimension

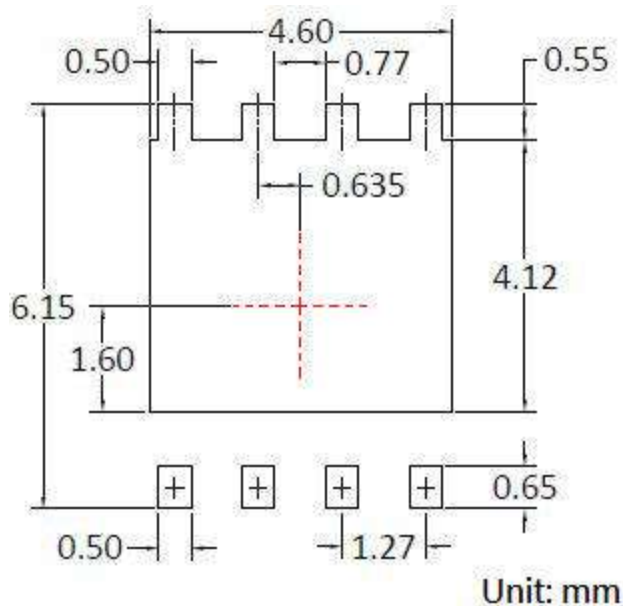
Package type: PDFN 5x6-8L



| Symbol | Min      | Nor  | Max  |
|--------|----------|------|------|
| A      | 0.90     | 1.04 | 1.17 |
| b      | 0.33     | 0.42 | 0.51 |
| C      | 0.06     | 0.20 | 0.35 |
| D1     | 4.80     | 5.10 | 5.40 |
| D2     | 3.61     | 3.96 | 4.31 |
| E      | 5.90     | 6.03 | 6.15 |
| E1     | 5.65     | 5.75 | 5.85 |
| E2     | 3.30     | 3.54 | 3.78 |
| e      | 1.27 BSC |      |      |
| H      | 0.38     | 0.50 | 0.61 |
| L      | 0.38     | 0.55 | 0.71 |
| L1     | 0.05     | 0.15 | 0.25 |

Unit : mm

## 6. Land pattern (Footprint)



- Note 1: Land pattern (Footprint) design is for reference only.
- Note 2: Package body sizes exclude mold flash and burrs.
- Note 3: Dimension is measured in gauge plane.
- Note 4: Tolerance 0.1mm unless otherwise specified.

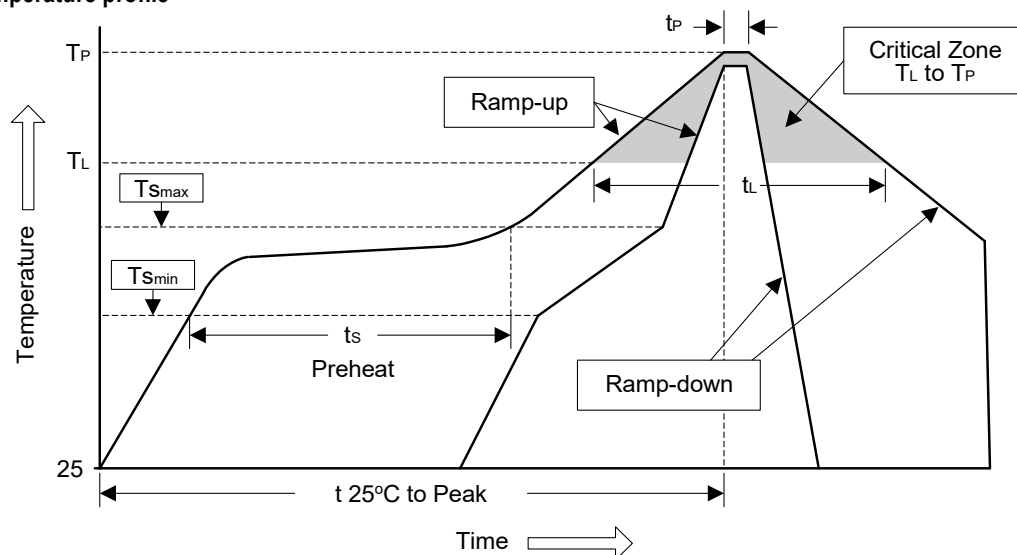


## 7. Appendix-A

### Soldering Methods for Silicongear's Products (Just for SMD type of device)

1. Storage environment: Temperature=10°C to 35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



| Profile Feature                                      | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|------------------------------------------------------|-------------------------|------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )              | <3°C/sec                | <3°C/sec         |
| Preheat                                              |                         |                  |
| - Temperature Min ( $T_{smin}$ )                     | 100°C                   | 150°C            |
| - Temperature Max ( $T_{smax}$ )                     | 150°C                   | 200°C            |
| - Time (min to max) ( $t_s$ )                        | 60 to 120 sec           | 60 to 180 sec    |
| $T_{smax}$ to $T_L$                                  |                         |                  |
| - Ramp-up Rate                                       | <3°C/sec                | <3°C/sec         |
| Time maintained above:                               |                         |                  |
| - Temperature ( $T_L$ )                              | 183°C                   | 217°C            |
| - Time ( $t_L$ )                                     | 60 to 150 sec           | 60 to 150 sec    |
| Peak Temperature ( $T_P$ )                           | 240°C +0/-5°C           | 260°C +0/-5°C    |
| Time within 5°C of actual Peak Temperature ( $t_P$ ) | 10 to 30 sec            | 20 to 40 sec     |
| Ramp-down Rate                                       | <6°C/sec                | <6°C/sec         |
| Time 25°C to Peak Temperature                        | <6 minutes              | <8 minutes       |

### 3. Flow (wave) soldering (solder dipping)

| Products         | Peak Temperature | Dipping Time |
|------------------|------------------|--------------|
| Pb devices.      | 245°C ±5°C       | 5sec ±1sec   |
| Pb-Free devices. | 260°C +0/-5°C    | 5sec ±1sec   |

**7. Appendix-B****Important Notice****© Silicongear Corporation**

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